

(19)



Europäisches Patentamt

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(11)

**EP 0 546 078 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:

**24.02.1999 Bulletin 1999/08**

(21) Application number: **91916656.1**

(22) Date of filing: **23.08.1991**

(51) Int. Cl.<sup>6</sup>: **A01N 25/08**

(86) International application number:  
**PCT/US91/06019**

(87) International publication number:  
**WO 92/03923 (19.03.1992 Gazette 1992/07)**

(54) **BIRDFOOD CONTAINING CAPSAICIN OR ITS DERIVATIVES OR ANALOGUES**

CAPSAICIN ODER SEINE DERIVATE ODER ANALOGE ENTHALTENDES VOGELFUTTER

GRAINES POUR OISEAUX CONTENANT DE LA CAPSAICINE, SES DERIVES OU SES  
ANALOGUES

(84) Designated Contracting States:  
**AT BE CH DE DK ES FR GB GR IT LI LU NL SE**

(30) Priority: **29.08.1990 US 574159**

(43) Date of publication of application:  
**16.06.1993 Bulletin 1993/24**

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(56) References cited:  
**US-A- 321 909**

- **Journal of Comparative and Physiological Psychology, Vol. 93, No. 6, 1979, "Reversal of Innate Aversions: Attempts to Induce a Preference for Chili Peppers in Rats", (ROZIN et al.). see entire document.**

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**Description**

## BACKGROUND OF THE INVENTION

5 Field of the Invention

[0001] The present invention relates to preparations of bird seed treated with a material containing capsaicin or capsaicin derivatives or analogues thereof (including resiniferatoxin (RTX) or RTX analogues) in an amount sufficient to be unpalatable to mammals (e.g., rodents), which have capsaicin receptors.

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Description of Related Art

[0002] U.S. Patent 779,634 by Allen discloses a poison composition for the extermination of rodents which are destructive to crops. The poison comprises one pound of cayenne pepper, three (3) gallons of bisulfide of carbon, and one gallon of carboic acid. A piece of absorbent material is saturated with the preparation and placed in locations frequented by unwanted rodents.

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[0003] U.S. Patent 631,738 by Dowie discloses a powdered composition for expelling rats consisting of twenty percent chili pepper, five percent hellebore, eight percent sulphate of lime, eight percent phosphate of lime, fifty four percent carbonate of lime and five percent oxide of iron. The powdered composition is intended to be sprinkled on the premises where rats are troublesome, and as a result of its intense irritating and burning qualities effectually prevents the rats from again invading places where the composition has been used. The hellebore and pepper are mixed with a medium to form a very light powder so as to float on the air and permeate the areas where the rats may be. It is said to be impossible to use hellebore without the pepper as it would be unbearable to human beings distributing it.

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[0004] U.S. Patent 4,455,304 by Yeralian discloses a method and composition for repelling birds from crops by applying the composition in the vicinity of the crop to be treated. The composition comprises finely divided garlic and finely divided dried cayenne pepper, the garlic being present in at least about one-fifth to at least five times the weight of the pepper, dry weight, and the total amount of garlic and pepper applied being from at least about 0.37 to 3.7 kilograms per hectare.

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[0005] Szolcsanyi et al, Pain, 27 (1986) 247-260, discloses the sensitivity of birds to the nociceptive action of capsaicin differs from that of mammals. This was investigated by local instillation of capsaicin into the eye and by close arterial injection in pigeons and guinea-pigs. More specifically, instillation of capsaicin into the eyes of the pigeons did not evoke more reactions than the solvent alone. Thus, pigeons were found to reveal selective insensitivity to capsaicin and the peripheral chemoreceptive nerve endings in pigeons are almost totally insensitive to capsaicin.

30

[0006] Capsaicin and its analogues have been commercially used as repellents, such as in HALT, an aerosol preparation sold to repel attacking dogs.

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[0007] Monsereenvsorn et al (1982) CRC Crit. Rev. Toxicol. 10, 321-339, discloses the physical and chemical properties of capsaicin.

[0008] Rozin, P. and Schiller, D., "The nature and acquisition of a preference for chili pepper by humans", Motiv. Emot. 4, 77-101, 1980, teaches that the maximum tolerated dose of chili pepper for humans is between 1,300 Scoville units (1 part in  $1.25 \times 10^4$  of capsaicin) and 10,400 Scoville units (1 part in  $1.5 \times 10^3$  of capsaicin).

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[0009] Rozin, P. and Gruss, L., and Berk, G., "Reversal of innate aversions: attempts to induce a preference for chili peppers in rats", J. Comp. Physiol. Psychol. 93, 1001-1014, 1979, teaches that incorporation of chili pepper in the feed of rats at a level of 400 Scoville units (corresponding to 1 part capsaicin in 40,000) causes 95% rejection of the treated food relative to untreated food. The report further teaches that the geometric mean for the avoidance threshold is 1 part capsaicin in  $1.5 \times 10^6$  and that all animals (out of 12 tested) avoided the treated feed at an avoidance threshold of 1 part capsaicin in 25,000 in the feed.

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[0010] Sann et al, Can. J. Physiol. Pharmacol. 65:1347-1354 (1987), teaches that the acute capsaicin effects on nociception in chickens upon close arterial injection were only observed at a dose two to three orders of magnitude higher than that in mammals.

[0011] Kare, Avian Physiology, P.D. Sturkie, Ed., Cornell University Press, Ithaca, N.Y. (1965) pp. 406-446, teaches that parrots willingly eat hot peppers.

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[0012] GB-A-0014829 discloses an egg-producing spice for poultry, which has the objective of providing an improved spice for mixing with food for ordinary fowl, ducks, or other poultry in general. The spice includes a variety of minerals and other ingredients, a variety of herbs and spices, such as cumin and ginseng, and includes powdered capsicum. There is no further disclosure of the nature of the capsicum ingredient.

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[0013] GB-A-0625624 relates to a composition that comprises red pepper and a carbonate of iron, with the intention of feeding this composition to canaries in order to impart red colour to their plumage. Neither of the ingredients alone will produce the desired result. In an example of the composition, 16 parts of ground red pepper and 1 part of iron car-

bonate are included in a total of 100 parts; the rest of the material can be meal and other food ingredients for the bird.

**[0014]** DE-A-3816215 discloses a spray or similar composition to be applied to forage and wild green plants that comprise food for animals in the wild. The composition contains cayenne pepper as the active ingredient in an aqueous dispersion of various polymers, and has the intention of repelling the foraging animals. These include large animals such as game, as well as ground animals such as mice and squirrels.

**[0015]** Szallari and Blumberg, *Neuroscience* 30(2):515-520 (1989), discloses that resiniferatoxin, a phorbol-related diterpene, acts as a potent analogue of capsaicin.

**[0016]** Birdseed for feeding wild birds represents a significant economic product. The annual value of birdseed production in the U.S. in 1987 was \$67.9 million (U.S. Department of Commerce). A birdseed which is palatable to birds but which is unpalatable to rodents would better meet the needs of two categories of consumers. Firstly, many bird-lovers apparently object to squirrels consuming the birdseed, as evidenced by the abundance of advertisements for squirrel-proof bird feeders. Such feeders represent only a partial solution to the problem, since the squirrels still consume the seed which is knocked out of the feeder and falls on the ground. Secondly, most birdfeeders are located near houses, and the fallen seed provides feed for mice. This causes an elevated mouse population in and around dwellings.

Borreliosis (Lyme disease) represents a major health concern in rural and outlying suburban areas. The vector for borreliosis is the larval stage of the deer tick (*Ixodes dammini*) and the predominant host is the white-footed mouse.

#### SUMMARY OF THE INVENTION

**[0017]** As part of the analysis of resiniferatoxin receptors, the present inventor examined the species specificity of the resiniferatoxin receptors, and became aware of the literature that capsaicin is only pungent, i.e., "hot", for mammals but not for birds. The inventor has also demonstrated experimentally that capsaicin receptors are not detectable in birds such as chickens, in contrast to mammals (data not shown).

**[0018]** According to the present invention, treated birdseed, which repels animals having capsaicin-sensitive receptors but does not repel birds, comprises:

(i) birdseed selected from sunflower seeds, millet, barley, oats, wheat, corn, peanuts, thistle seed, sorghum, sudan grass seed, watergrass seed, clover seed and mixtures thereof, and

(ii) a material containing a pungent substance which repels animals having capsaicin-receptors but is palatable to birds which do not have such receptors, wherein the substance is capsaicin, or a derivative or an analogue thereof that acts in the same fashion as capsaicin, wherein the material is coated on, impregnated in or mixed with said birdseed, and wherein the treated birdseed comprises no more than 100,000 parts by weight birdseed per part by weight of said substance.

**[0019]** A further aspect of the present invention is a method of selectively repelling animals having capsaicin-sensitive receptors, by feeding the treated birdseed to birds.

**[0020]** The use of birdseed that is unpalatable to the white-footed mouse may represent one aspect of rodent control.

#### DESCRIPTION OF THE INVENTION

**[0021]** The pungent (or "hot") substance that is used in treated birdseed of the invention repels animals having capsaicin sensitive receptors by discouraging said animals from eating the treated "hot" birdseed, with the proviso that the treated birdseed does not have effective amounts of other ingredients that would repel the birds. In other words, the claimed composition may contain additional material except for material that would repel the birds from the birdseed or that would kill the birds or make them sick. Examples of compounds that would repel birds when used in sufficient quantity include garlic, wattle tannin, aluminum ammonium sulfate, dimethyl anthranilate, and methiocarb [3,5-dimethyl-4-(methylthio)-phenol methylcarbamate]. Examples of compounds that would kill the birds or make them sick include poisons or caustic substances. Small trace amounts of these compounds that are typically used to repel or kill the birds may be present as long as the birds are not adversely affected by such trace amounts.

**[0022]** Individual seed types or mixtures of seed are treated with capsaicin or derivatives or analogues thereof, including dihydrocapsaicin, homovanillyl octylester, nonanoyl vanillylamide, or other pungent compounds of the class known as vanilloids. Other capsaicin analogues having the desired "hot" properties include resiniferatoxin, tinyatoxin, or other related resiniferatoxin analogues. This latter class of compounds has been demonstrated to act in the same fashion as capsaicin. Additional types of capsaicin derivatives or analogues include heptanoyl isobutylamide, heptanoyl guaiacylamide, or other isobutylamides or guaiacylamides. All of these compounds are representative of capsaicin derivatives or analogues, that is, those compounds which are "hot" to animals having capsaicin sensitive receptors but are palatable to birds which do not have such receptors. Capsaicin derivatives or analogues per se are well known in the art. Representative types of capsaicin derivatives or analogues suitable for use in the present invention are described in a

collective list set forth by Newman, "Natural and synthetic pepper flavored substances", Chemical Products, 1954; and Hayes et al "The effect of a series of capsaicin analogues on nociception and body temperature in the rat", Life Sciences, Vol. 34, pp. 1241-1248.

5 [0023] The preferred types of capsaicin derivatives are selected from the group consisting of dihydrocapsaicin, non-andyl vanillylamide and homovanillyl nonylester. The proportions of capsaicin or capsaicin derivatives or analogues to seed should be in the range of 1 part in 200 to 1 part in 2,000,000 by weight. Preferably, the proportions should be 1 part in 2000 to 1 part in 100,000. For resiniferatoxin (RTX), the proportions of RTX should be 1 part in 2000 to 1 part in 20,000,000. Preferably, the proportions should be 1 part in 20,000 to 1 part in 20,000,000.

10 [0024] The material containing capsaicin or a derivative or an analogue thereof can be either mixed with the birdseed, impregnated in, or coated thereon. The compounds can be applied to the seed by a variety of coating methods, e.g., soaking, spraying, mixing, after dissolving in an organic solvent such as ethanol or methanol or in a mixture of solvents containing ethanol or methanol and water and detergent, e.g., Triton X-100 or Tween-80, or in such solvents together with a coating agent or binder, e.g., starch, dextrin, gelatin, methyl cellulose, acacia, or sodium alginate. These coating agents are preferably present in the amount of 5-20 % in the coating solution.

15 [0025] The types of animals which are discouraged from eating birdseed are typically mammals such as rodents and more specifically, squirrels, mice or rats.

[0026] In place of treatment with the purified or partially purified compounds, the seed may be treated with plant material, sap or extracts from such plants which contain either capsaicin, resiniferatoxin or other capsaicin analogues. These plants are, respectively, "hot peppers" of the genus Capsicum, or one of the three Euphorbia species E. resiniferatoxin,  
20 E. poissonii, and E. unispina. The compounds in the Capsicum genus are concentrated in the fruits, or peppers. The compounds in the Euphorbias species are concentrated in the sap or latex. The recommended procedure would therefore be to use the peppers or latex, although the invention is not restricted to their use. Since the approximate concentration of capsaicin is 0.5 to 5% in the dried pepper and the concentration of resiniferatoxin in the dried sap of the above Euphorbias is 0.05%, the proportions should be adjusted according to the amount of active ingredient. Accordingly, in  
25 a preferred embodiment, ground red peppers may be mixed with or coated on and/or impregnated in the birdseed.

[0027] If the compounds are partially purified such as by extraction of the plant material with methanol, the proportions should again be adjusted to maintain an effective amount of active ingredient for repelling animals having capsaicin sensitive receptors. A procedure for extraction of resiniferatoxin is described in Schmidt, R.J. and Evans, F.J., "A new aromatic ester diterpene from Euphorbia poissonii", Phytochemistry 15: 1778-1779, 1976. Among other methods, cap-  
30 saicin can be extracted by incubation of the ground peppers with 2 volumes of methanol for 24 hr. at room temperature followed by filtration.

[0028] The structure of capsaicin and representative analogues and derivatives thereof are shown below.

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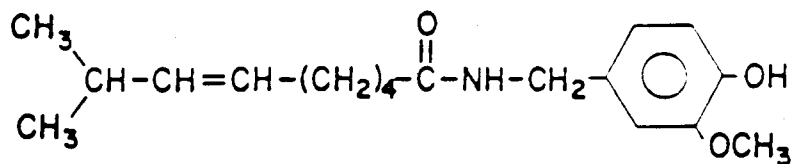
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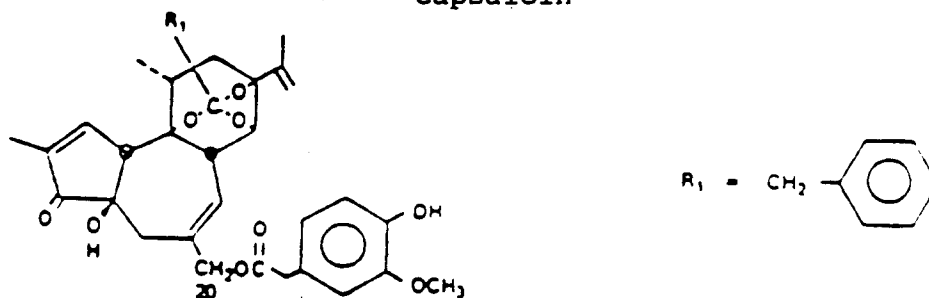
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Capsaicin

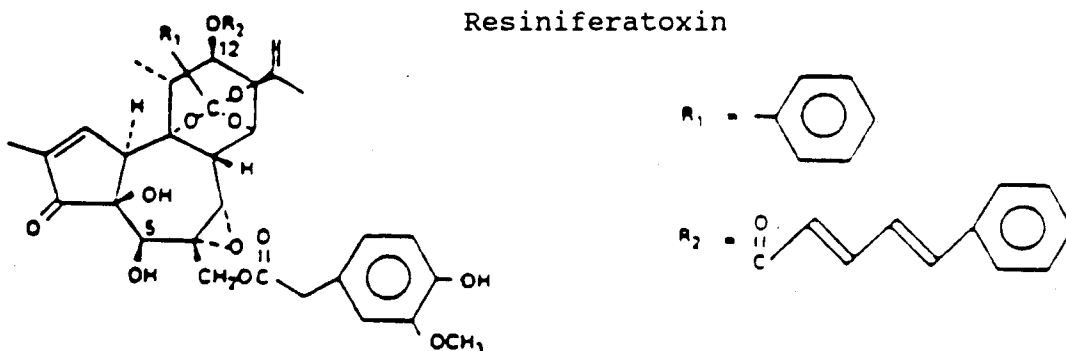
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Resiniferatoxin

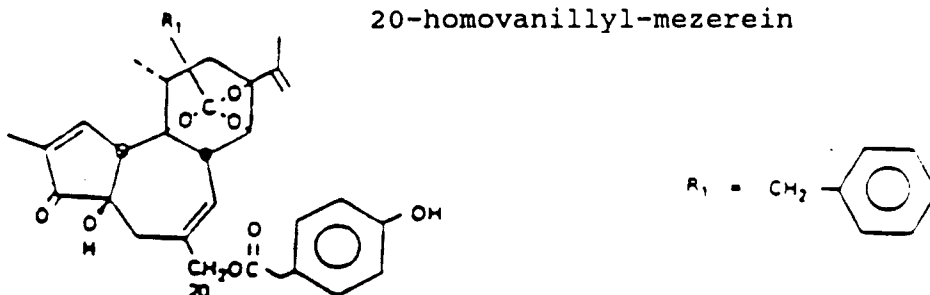
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20-homovanillyl-mezerein

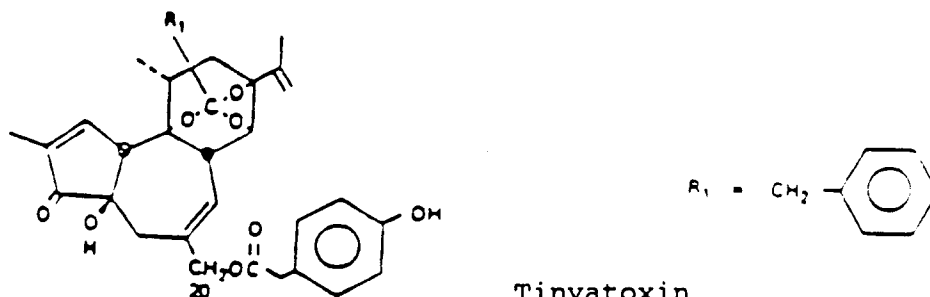
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20-homovanillyl-12-deoxyphorbol 13-phenylacetate

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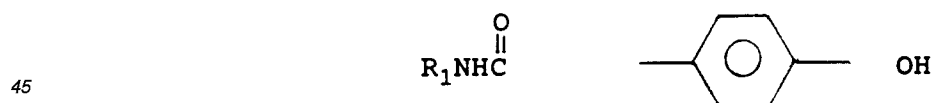
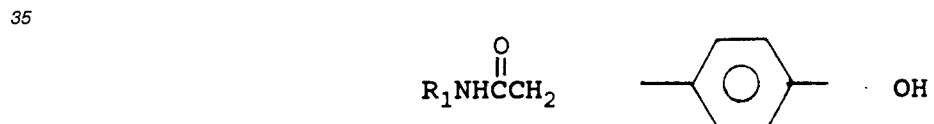
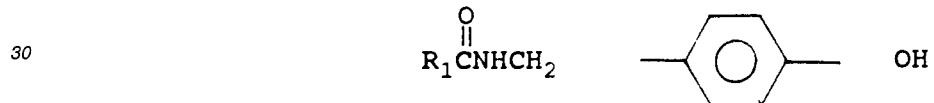
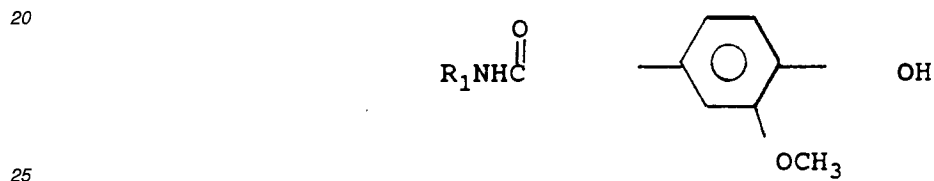
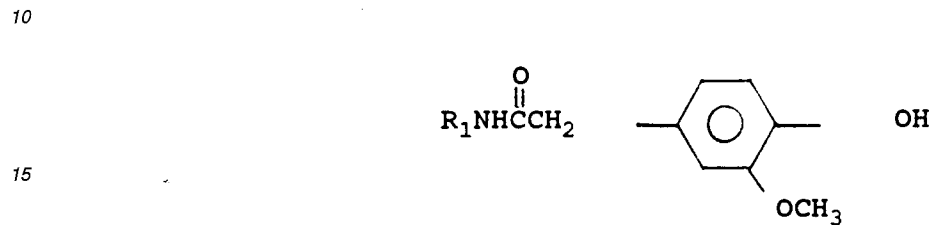
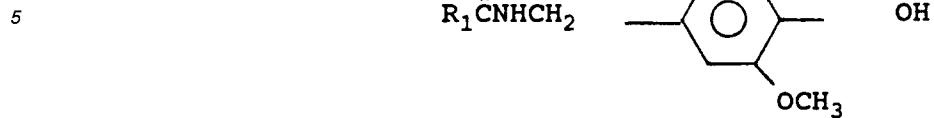
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Tinyatoxin

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[0029] Additional examples of capsaicin derivatives are as follows.

EXAMPLES



wherein  $R_1 = C_nH_{2(n-i)+1}$

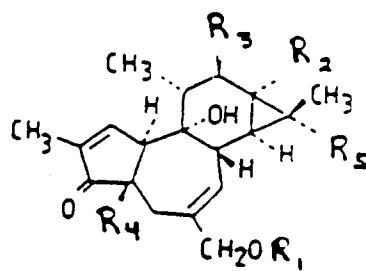
where  $n = 1-20$

$i = 0-4$

55 [0030] U.S. Patent 4,939,149 as well as U.S. Serial No. 07/358,073 filed May 30, 1989 describe various types of capsaicin derivatives or analogues within the scope of the present invention. These compounds include those represented by formulas (I)-(IV):

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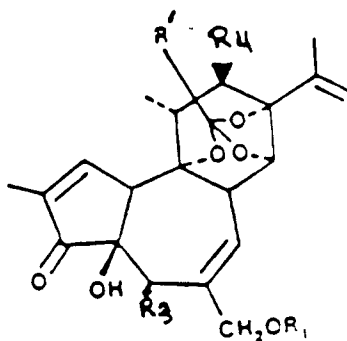
I



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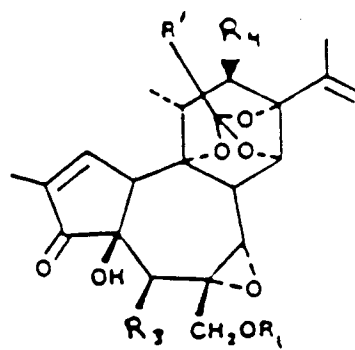
II



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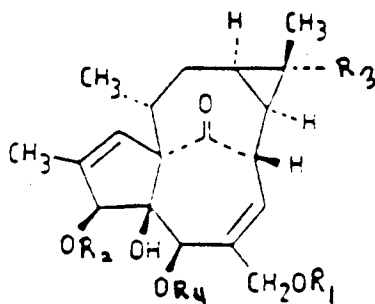
III



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IV



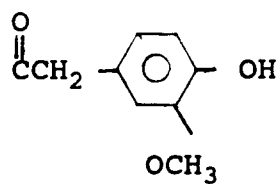
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werein R<sub>1</sub> in all cases represents

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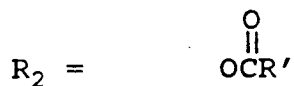
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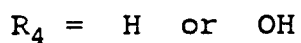
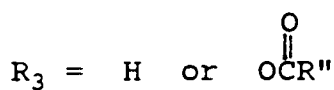
10 to yield 20-homovanillyl esters of diterpenes of the tigliane (I), daphnane (II and III), and ingenane (IV) classes. Specific substitutions are as follows:

I:

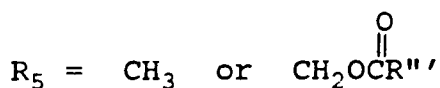
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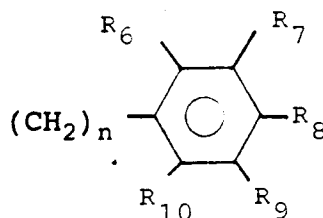
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wherein at least one of R', R'', or R''' are aromatic and the remainder are  $(\text{CH}_2)_n - \text{CH}_3$  wherein n' is 0=14. For instance, the aromatic group may be

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wherein  $R_6-R_{10}$  each independently may represent OH,  $\text{OCH}_3$  or H and wherein n is 0 - 10. Preferably, the aromatic group is

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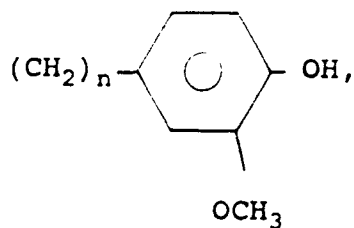


or

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(wherein n = 0 - 10)

II and III:

R' is aromatic as defined above;

15 R<sub>3</sub> is H, OH or  $\begin{array}{c} \text{O} \\ || \\ \text{OCR}'' \end{array}$

where R'' is aromatic as defined above,

20 R<sub>4</sub> is H or  $\begin{array}{c} \text{O} \\ || \\ \text{OCR}''' \end{array}$

25 where R''' is aromatic as defined above.

IV:

30 R<sub>2</sub> =  $\begin{array}{c} \text{O} \\ || \\ \text{CR}' \end{array}$

35 R<sub>3</sub> = CH<sub>3</sub> or  $\begin{array}{c} \text{O} \\ || \\ \text{CH}_2\text{OCR}'' \end{array}$

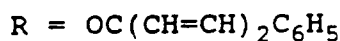
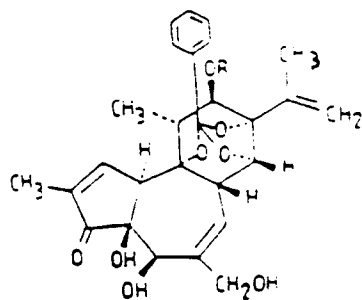
40 R<sub>4</sub> = H or  $\begin{array}{c} \text{O} \\ || \\ \text{CR}''' \end{array}$

where R', R'', or R''' is aromatic as defined above.

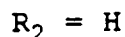
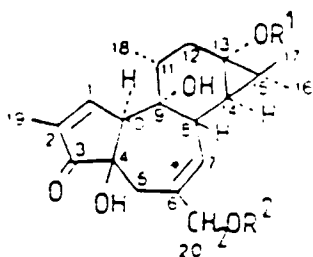
**[0031]** Representative examples of compounds of formulas (I)-(IV) include 20-homovanillyl-mezerein and 20-homovanillyl-12-deoxyphorbol-13-phenylacetate.

**[0032]** Useful compounds may be produced by the process of reacting phorbol-related diterpenes and homovanillic acid by esterification at the exocyclic hydroxy group of the diterpene.

**[0033]** Furthermore, esterification of phorbol-related diterpenes with homovanillic acid can yield capsaicin analogues with unique activities. Representative examples of the phorbol-related diterpenes are:



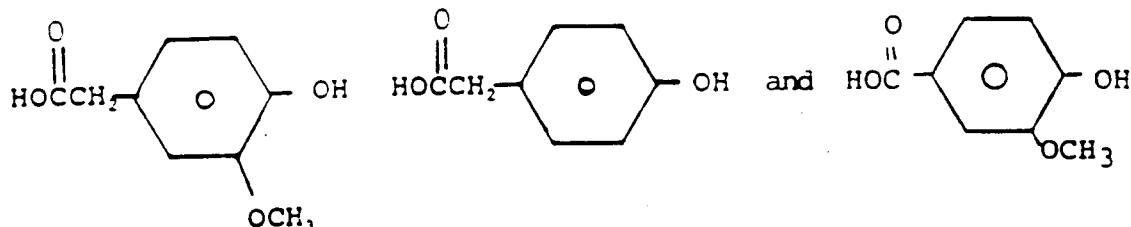
Mezerein



12-deoxyphorbol 13-phenylacetate

30 The phorbol related diterpenes may be selected from the group consisting of tiglanes, daphnanes or ingenanes.

[0034] Representative examples of homovanillic acid and congeners are:



Homovanillic acid itself or congeners possessing a pattern of substitution which would confer capsaicin-like activity were it in a capsaicin-like structure may also be used.

45 [0035] The compounds of the invention, resiniferatoxin (RTX) and tinyatoxin (TTX) may be prepared using the methodology for esterification as set forth in *J. Natural Prod.* Vol. 45, p. 348 (1982).

[0036] The following Examples are intended to illustrate the claimed invention and will enable others skilled in the art to understand the invention more completely. However, the invention should not be interpreted as being limited to only these representative examples.

50 EXAMPLE 1

[0037] 10 kilograms of mixed seed, including 2 kilograms each of sunflower seed, millet, sorghum, oats and rye are thoroughly mixed with a suspension of 100 g powdered cayenne pepper (40,000 Scoville units) in 750 ml of 2% methylcellulose. After mixing, the treated seed is air dried.

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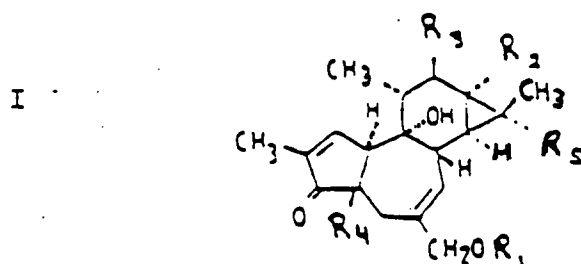
EXAMPLE 2

[0038] 5 kilograms of millet is moistened with 500 ml of 95% ethanol containing 125 mg dihydrocapsaicin. The seed is warmed to 40°C under reduced pressure with agitation until dry.

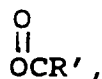
[0039] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

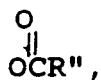
1. Treated birdseed, which repels animals having capsaicin-sensitive receptors but does not repel birds, comprising:
  - (i) birdseed selected from sunflower seeds, millet, barley, oats, wheat, corn, peanuts, thistle seed, sorghum, sudan grass seed, watergrass seed, clover seed and mixtures thereof, and
  - (ii) a material containing a pungent substance which repels animals having capsaicin-receptors but is palatable to birds which do not have such receptors, wherein the substance is capsaicin, or a derivative or an analogue thereof that acts in the same fashion as capsaicin, wherein the material is coated on, impregnated in or mixed with said birdseed, and wherein the treated birdseed comprises no more than 100,000 parts by weight birdseed per part by weight of said substance.
2. The treated birdseed of claim 1, wherein said material is coated on or impregnated in the birdseed.
3. The treated birdseed of claim 1, wherein the animal is a mammal.
4. The treated birdseed of claim 3, wherein the mammal is a rodent.
5. The treated birdseed of claim 4, wherein the rodent is a squirrel, a mouse or a rat.
6. The treated birdseed of any preceding claim, which comprises 200 to 100,000 parts by weight birdseed per part by weight of said substance.
7. The treated birdseed of claim 6, which comprises 2,000 to 10,000 parts by weight birdseed per part by weight of said substance.
8. The treated birdseed of any preceding claim, wherein the capsaicin analogue is selected from formulae (I)-(IV):



wherein in formula (I), R<sub>2</sub> is

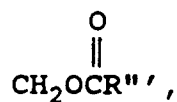


R<sub>3</sub> is H or



R<sub>4</sub> is H or OH, R<sub>5</sub> is CH<sub>3</sub> or

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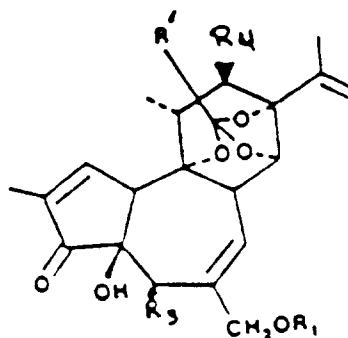


and wherein at least one of R', R'' and R''' is an aromatic group and the remainder are (CH<sub>2</sub>)<sub>n</sub>-CH<sub>3</sub> wherein n' is 0-14;

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II

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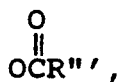
wherein in formula (II), R<sub>3</sub> is H, OH or

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30

R<sub>4</sub> is H or



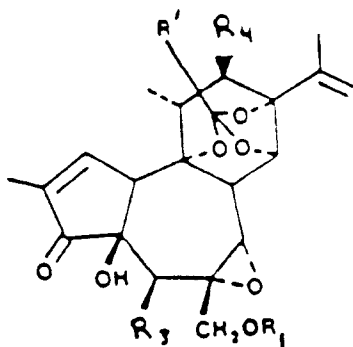
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and R', R'' and R''' are as defined above;

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III

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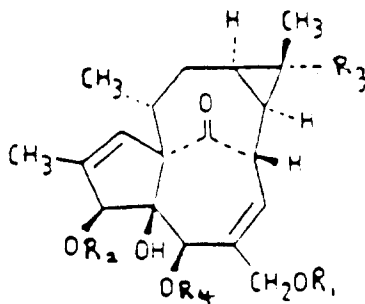


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wherein in formula (III), R<sub>3</sub>, R<sub>4</sub>, R', R'' and R''' are the same as defined in formula (II); and

55

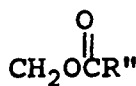
IV



wherein in formula (IV), R<sub>2</sub> is



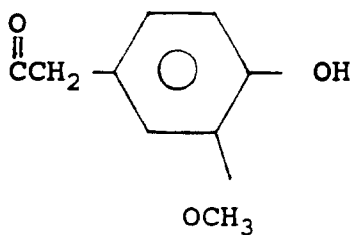
R<sub>3</sub> is CH<sub>3</sub> or



and R<sub>4</sub> is H or



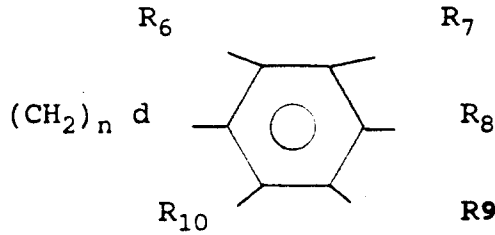
and R', R'' and R''' are as defined above;  
wherein R<sub>1</sub> in formulas (I) - (IV) represents



9. The treated birdseed of claim 8, wherein the capsaicin analogue or derivative is 20-homovanillyl-mezerein, 20-homovanillyl-12-deoxyphorbol-13-phenyl-acetate, homovanillyl heptylester, homovanillyl octylester, homovanillyl nonylester, homovanillyl decylester, homovanillyl undecylester, homovanillyl dodecylester, homovanillyl heptylamide, homovanillyl octylamide, homovanillyl nonylamide, homovanillyl decylamide, homovanillyl undecylamide, homovanillyl dodecylamide, heptanoyl vanillylamide, octanoyl vanillylamide, nonanoyl vanillylamide, decanoyl vanillylamide, undecanoyl vanillylamide, dodecanoyl vanillylamide, dihydrocapsaicin, heptanoyl isobutylamide, octanoyl isobutylamide, nonanoyl isobutylamide, octanoyl guaiacylamide, nonanoyl guaiacylamide or decanoyl guaiacylamide.

10. The treated birdseed of claim 8, wherein for the capsaicin analogue, the aromatic group of R', R'' and R''' in formulas (I) - (IV) is as follows:

5



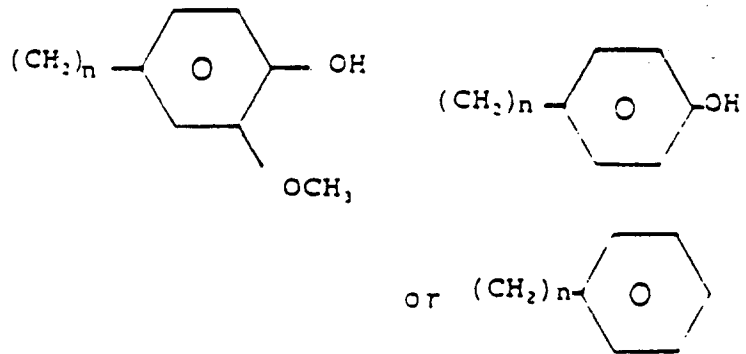
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wherein  $R_6 - R_{10}$  each independently represents OH,  $OCH_3$  or H; and n is 0 - 10.

15

11. The treated birdseed of claim 8, wherein for the capsaicin analogue, the aromatic group of R', R'' and R''' in formulas (I) - (IV) is

20



25

wherein n is 0-10.

30

12. The treated birdseed of claim 8, wherein the capsaicin analogue is tinyatoxin.

13. The treated birdseed of claim 8, wherein the capsaicin analogue is resiniferatoxin.

35

14. The treated birdseed of claim 13, wherein the proportion of resiniferatoxin to seed is in the range of about 1 part in 2,000 to 1 part in  $10^5$  by weight.

15. The treated birdseed of claim 13, wherein the proportion of resiniferatoxin to seed is in the range of about 1 part in 20,000 to 1 part in  $10^5$  by weight.

40

16. The treated birdseed of claim 1, wherein the seed is treated with plant material or plant extracts from plants which contain capsaicin, resiniferatoxin or analogues or derivatives thereof.

17. The treated birdseed of claim 1, wherein the analogue of capsaicin is dihydrocapsaicin.

45

18. The treated birdseed of claim 1, wherein the analogue of capsaicin is nonanoyl vanillylamide.

19. The treated birdseed of claim 1, wherein the analogue of capsaicin is homovanillyl nonylester.

50

20. A method of selectively repelling animals having capsaicin sensitive receptors, which comprises feeding treated birdseed of claim 1 to birds.

**Patentansprüche**

55

1. Behandeltes Vogelfutter, das Tiere mit Capsaicin-empfindlichen Rezeptoren abstößt, Vögel jedoch nicht abstößt, bestehend aus:

i) Vogelfutter, das aus Sonnenblumenkernen, Hirse, Gerste, Hafersorten, Weizen, Mais, Erdnüssen, Distelsa-

men, Sorghum, Sudangrassamen, Wassergrassamen, Kleesamen und Gemischen hiervon ausgewählt ist, und

ii) einem Material, das eine scharfe Substanz enthält, das Tiere mit Capsaicin-Rezeptoren abstößt, aber für Vögel ohne solche Rezeptoren genießbar ist, wobei die Substanz Capsaicin oder ein Derivat oder ein Analog hiervon ist das in gleicher Weise wie Capsaicin wirkt, wobei das Material als Beschichtung auf dem Vogelfutter, als Imprägnierung des Vogelfutters oder gemischt mit dem Vogelfutter vorliegt, und wobei das behandelte Vogelfutter nicht mehr als 100.000 Gewichtsteile Vogelfutter pro Gewichtsteil dieser Substanz enthält.

2. Behandeltes Vogelfutter nach Anspruch 1, wobei das Material auf dem Vogelfutter beschichtet oder darin imprägniert ist.

3. Behandeltes Vogelfutter nach Anspruch 1, wobei das Tier ein Säugetier ist.

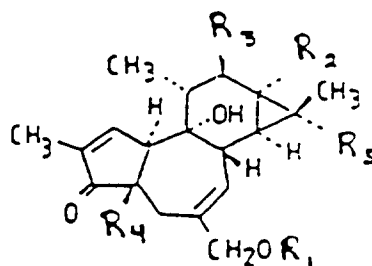
4. Behandeltes Vogelfutter nach Anspruch 3, wobei das Säugetier ein Nagetier ist.

5. Behandeltes Vogelfutter nach Anspruch 4, wobei das Nagetier ein Eichhörnchen, eine Maus oder eine Ratte ist.

6. Behandeltes Vogelfutter nach einem der vorhergehenden Ansprüche, welches 200 bis 100.000 Gewichtsteile Vogelfutter pro Gewichtsteil der genannten Substanz enthält.

7. Behandeltes Vogelfutter nach Anspruch 6, das 2.000 bis 10.000 Gewichtsteile Vogelfutter pro Gewichtsteil der genannten Substanz enthält.

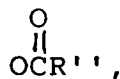
8. Behandeltes Vogelfutter nach einem der vorhergehenden Ansprüche, wobei das Capsaicin-Analog aus den Formeln I bis IV ausgewählt ist:



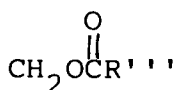
wobei in Formel I R<sub>2</sub> als



R<sub>3</sub> als H oder als



R<sub>4</sub> als H oder OH, R<sub>5</sub> als CH<sub>3</sub> oder



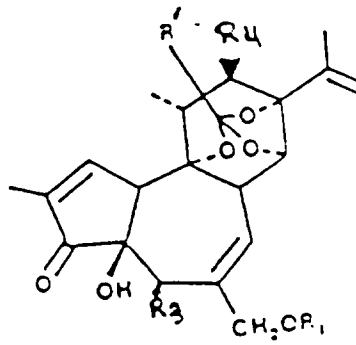
vorliegt, und wobei mindestens eines von R', R'' und R''' eine aromatische Gruppe und der Rest (CH<sub>2</sub>)<sub>n</sub>-CH<sub>3</sub> ist,

wobei n' 0 bis 14 beträgt;

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II

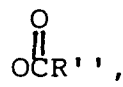
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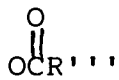
wobei in Formel II R<sub>3</sub> als H, OH oder

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R<sub>4</sub> als H oder

25

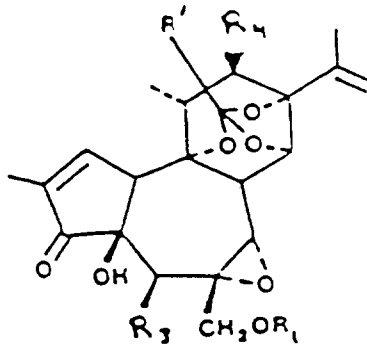


vorliegt, und R', R'' und R''' wie oben definiert sind;

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III

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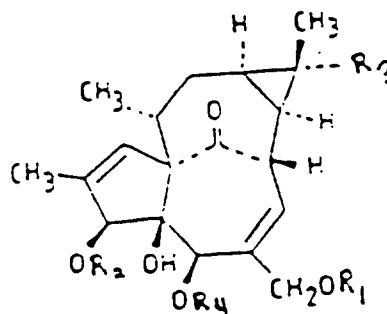
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wobei in Formel III R<sub>3</sub>, R<sub>4</sub>, R', R'' und R''' wie in Formel II definiert sind, und

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IV

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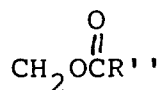
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wobei in Formel IV R<sub>2</sub> als



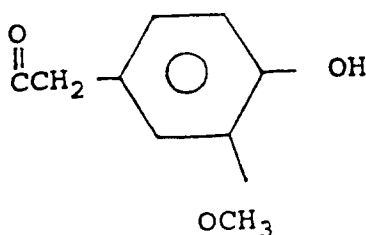
R<sub>3</sub> als CH<sub>3</sub> oder



vorliegt und R<sub>4</sub> als H oder



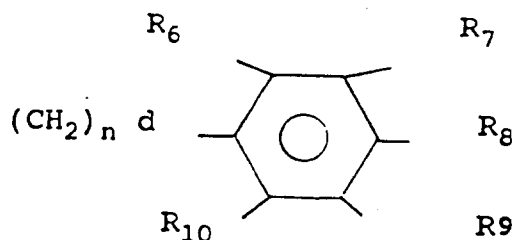
vorliegt und R', R'' und R''' wie oben definiert sind,  
und wobei R<sub>1</sub> in den Formeln I bis IV jeweils



darstellt.

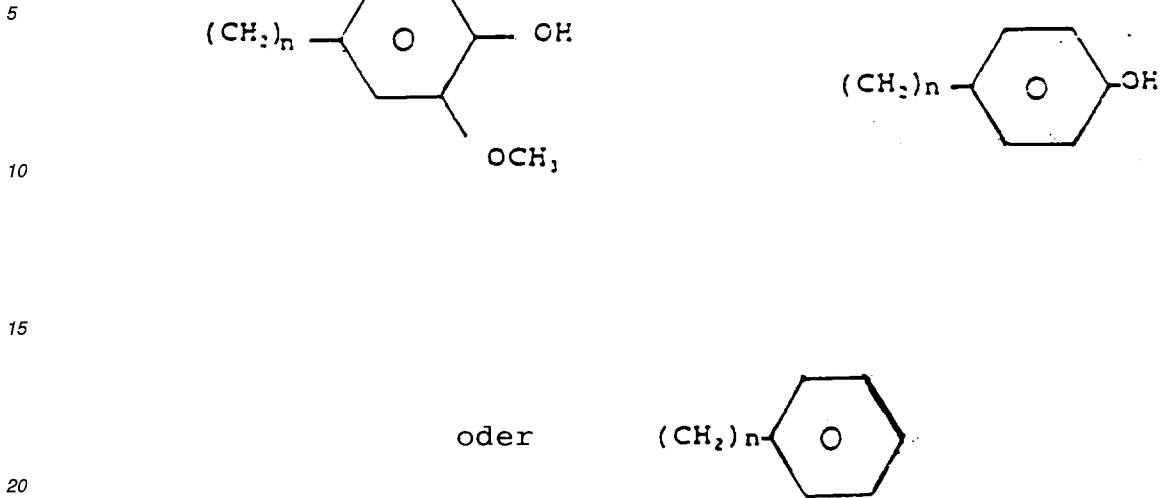
9. Behandeltes Vogelfutter nach Anspruch 8, wobei das Capsaicin-Analog- oder -Derivat ein 20-Homovanillyl-Mezer-  
ein, 20-Homovanillyl-12-Desoxyphorbol-13-Phenylacetat, Homovanillyl-Heptylester, Homovanillyl-Octylester,  
Homovanillyl-Nonylester, Homovanillyl-Decylester, Homovanillyl-Undecylester, Homovanillyl-Dodecylester, Homo-  
vanillyl-Heptylamid, Homovanillyl-Octylamid, Homovanillyl-Nonylamid, Homovanillyl-Decylamid, Homovanillyl-  
Undecylamid, Homovanillyl-Dodecylamid, Heptanoyl-Vanillylamid, Octanoyl-Vanillylamid, Nonanoyl-Vanillylamid,  
Decanoyl-Vanillylamid, Undecanoyl-Vanillylamid, Dodecanoyl-Vanillylamid, Dihydrocapsaicin, Heptanoyl-Isobutyl-  
amid, Octanoyl-Isobutylamid, Nonanoyl-Isobutylamid, Octanoyl-Guaiacylamid, Nonanoyl-Guaiacylamid oder  
Decanoyl-Guaiacylamid ist.

10. Behandeltes Vogelfutter nach Anspruch 8, wobei bei dem Capsaicin-Analog die aromatische Gruppe von R', R''  
und R''' in den Formeln I bis IV folgendermaßen ist:



wobei R<sub>6</sub> bis R<sub>10</sub> jeweils unabhängig OH, OCH<sub>3</sub> oder H darstellen und n den Wert 0 bis 10 hat.

11. Behandeltes Vogelfutter nach Anspruch 8, wobei bei dem Capsaicin-Analog die aromatische Gruppe von R', R'' und R''' in den Formeln I bis IV



ist, wobei n den Wert 0 bis 10 hat.

- 25 12. Behandeltes Vogelfutter nach Anspruch 8, wobei das Capsaicin-Analog Tinyatoxin ist.
13. Behandeltes Vogelfutter nach Anspruch 8, wobei das Capsaicin-Analog Resiniferatoxin ist.
- 30 14. Behandeltes Vogelfutter nach Anspruch 13, wobei der Anteil von Resiniferatoxin zum Vogelfutter im Bereich von etwa ein Teil in 2.000 Teilen bis ein Teil in  $10^5$  Teilen nach Gewicht beträgt.
15. Behandeltes Vogelfutter nach Anspruch 13, wobei der Anteil von Resiniferatoxin im Vogelfutter im Bereich von etwa ein Teil in 20.000 Teilen bis ein Teil in  $10^5$  Teilen nach Gewicht liegt.
- 35 16. Behandeltes Vogelfutter nach Anspruch 1, wobei das Vogelfutter mit Pflanzenmaterial oder Pflanzenextrakten aus Pflanzen behandelt ist, die Capsaicin, Resiniferatoxin oder Analoge oder Derivate hiervon enthalten.
17. Behandeltes Vogelfutter nach Anspruch 1, wobei das Capsaicin-Analog Dihydrocapsaicin ist.
- 40 18. Behandeltes Vogelfutter nach Anspruch 1, wobei das Capsaicin-Analog Nonanoyl-Vanillylamid ist.
19. Behandeltes Vogelfutter nach Anspruch 1, wobei das Capsaicin-Analog Homovanillyl-Nonylester ist.
20. Verfahren zum selektiven Abstoßen von Tieren mit Capsaicin-empfindlichen Rezeptoren, welches das Füttern von behandeltem Vogelfutter nach Anspruch 1 an Vögel umfaßt.
- 45

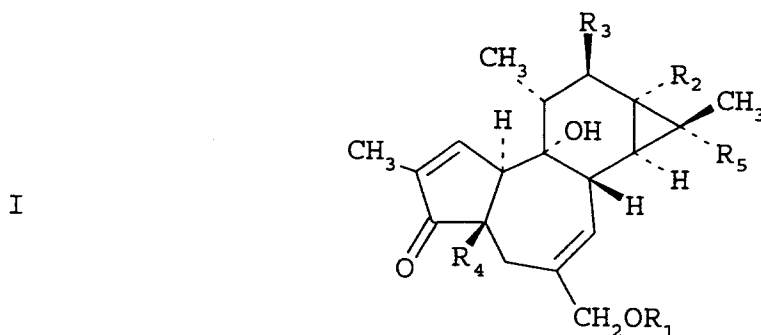
### Revendications

- 50 1. Graines pour oiseaux traitées repoussant les animaux qui possèdent des récepteurs sensibles à la capsaïcine mais qui ne repoussent pas les oiseaux, comprenant :
- (i) des graines pour oiseaux choisies parmi les graines de tournesol, le millet, l'orge, l'avoine, le blé, le maïs, les graines d'arachide, les graines de chardon, le sorgho, les graines de sésame, les graines de paspalum, les graines de trèfle, ainsi que des mélanges de ceux-ci, et
- 55 (ii) un matériau contenant une substance piquante qui repousse les animaux possédant des récepteurs de la capsaïcine mais qui présente un goût agréable pour les oiseaux dépourvus de tels récepteurs, ladite substance étant la capsaïcine ou bien un dérivé ou un analogue de celle-ci qui agit de la même manière que la capsaïcine, le matériau étant déposé sur, imprégné dans ou mélangé avec lesdites graines pour oiseaux, et

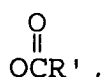
EP 0 546 078 B1

lesdites graines traitées ne contenant pas plus de 100.000 parties en poids de graines pour oiseaux pour une partie en poids de ladite substance.

- 5 2. Graines pour oiseaux traitées selon la revendication 1, dans lesquelles les graines sont enrobées ou imprégnées avec ledit matériau.
3. Graines pour oiseaux traitées selon la revendication 1, ledit animal étant un mammifère.
4. Graines pour oiseaux traitées selon la revendication 3, ledit mammifère étant un rongeur.
- 10 5. Graines pour oiseaux traitées selon la revendication 4, ledit rongeur étant un écureuil, une souris ou un rat.
6. Graines pour oiseaux traitées selon l'une quelconque des revendications précédentes, comprenant de 200 à 100 000 parties en poids de graines pour oiseaux pour une partie en poids de ladite substance.
- 15 7. Graines pour oiseaux traitées selon la revendication 6, comprenant de 2 000 à 10 000 parties en poids de graines pour oiseaux pour une partie en poids de ladite substance.
- 20 8. Graines pour oiseaux traitées selon l'une quelconque des revendications précédentes, dans lesquelles l'analogue de la capsaïcine est choisi parmi les formules (I) à (IV) :

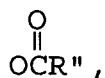


35 dans lesquelles, dans la formule (I), R<sub>2</sub> est



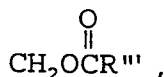
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R<sub>3</sub> est H ou



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R<sub>4</sub> est H ou OH, R<sub>5</sub> est CH<sub>3</sub> ou



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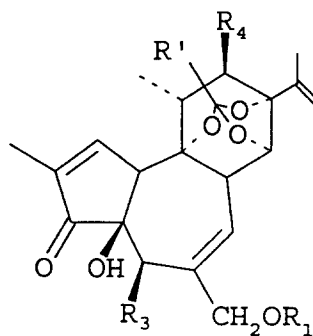
et dans lesquelles un au moins parmi R', R'' ou R''' est aromatique et les restants sont (CH<sub>2</sub>)<sub>n</sub>-CH<sub>3</sub> avec n = 0 à 14 ;

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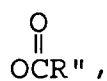
II

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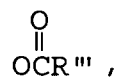
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dans lesquelles, dans la formule (II), R<sub>3</sub> est H, OH ou



20

R<sub>4</sub> est H ou



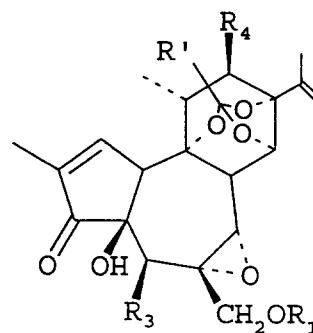
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et R', R'' et R''' sont tels que définis ci-dessus ;

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III

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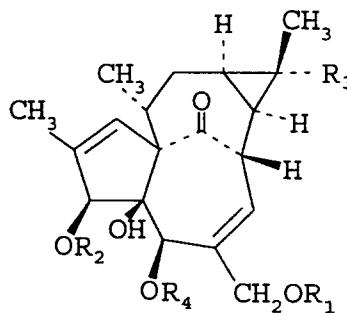
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Dans lesquelles, dans la formule (III), R<sup>3</sup>, R<sup>4</sup>, R', R'' et R''' sont les mêmes que ceux définis dans la formule (II) ; et

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IV

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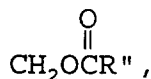


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dans lesquelles, dans la formule (IV), R<sub>2</sub> est



5 R<sub>3</sub> est CH<sub>3</sub> ou



10 R<sub>4</sub> est H ou

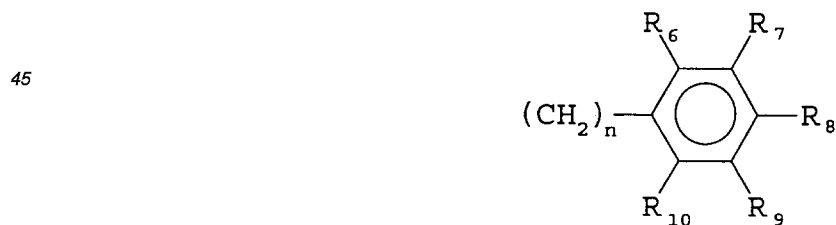


15 et R', R'' et R''' sont tels que définis ci-dessus ; dans lesquelles R<sub>1</sub>, dans les formules (I) à (IV), représente :



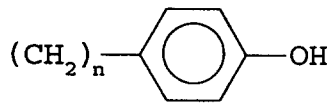
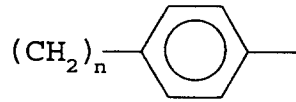
30 9. Graines pour oiseaux traitées selon la revendication 8, dans lesquelles l'analogue ou dérivé de la capsaïcine est la 20-homovanillylmézérine, le 13-phénylacétate de 20-homovanillyl-12-désoxyphorbol, l'ester heptylique d'homovanillyle, l'ester octylique d'homovanillyle, l'ester nonylique d'homovanillyle, l'ester décyclique d'homovanillyle, l'ester undécyclique d'homovanillyle, l'ester dodécyclique d'homovanillyle, l'heptylamide d'homovanillyle, l'octylamide d'homovanillyle, le nonylamide d'homovanillyle, le décylamide d'homovanillyle, l'undécylamide d'homovanillyle, le dodécylamide d'homovanillyle, le vanillylamide d'heptanoyle, le vanillylamide d'octanoyle, le vanillylamide de nonanoyle, le vanillylamide de décanoyle, le vanillylamide d'undécanoyle, le vanillylamide de dodécanoyle, la dihydrocapsaïcine, l'isobutylamide d'heptanoyle, l'isobutylamide d'octanoyle, l'isobutylamide de nonanoyle, le guaicylamide d'octanoyle, le guaicylamide de nonanoyle ou le guaicylamide de décanoyle.

40 10. Graines pour oiseaux traitées selon la revendication 8, dans lesquelles, pour l'analogue de la capsaïcine, le groupe aromatique de R', R'' et R''' dans les formules (I) à (IV) a la formule suivante :

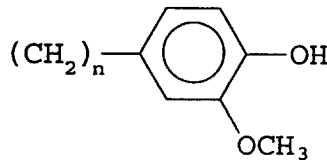


dans laquelle R<sub>6</sub> à R<sub>10</sub> représentent chacun indépendamment OH, OCH<sub>3</sub> ou H et n vaut de 0 à 10.

55 11. Graines pour oiseaux traitées selon la revendication 8, dans lesquelles, pour l'analogue de la capsaïcine, le groupe aromatique de R', R'' et R''' dans les formules (I) à (IV) a les formules suivantes :



ou



avec  $n = 0$  à  $10$ .

20

12. Graines pour oiseaux traitées selon la revendication 8, dans lesquelles l'analogue de la capsaïcine est la tinyatoxine.

25

13. Graines pour oiseaux traitées selon la revendication 8, dans lesquelles l'analogue de la capsaïcine est la résinifératoxine.

14. Graines pour oiseaux traitées selon la revendication 13, dans lesquelles la proportion de résinifératoxine par rapport aux graines est comprise dans la plage de 1 partie pour 2 000 à 1 partie pour  $10^5$  en poids.

30

15. Graines pour oiseaux traitées selon la revendication 13, dans lesquelles la proportion de résinifératoxine par rapport aux graines est comprise dans la plage de 1 partie pour 20 000 à 1 partie pour  $10^5$  en poids.

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16. Graines pour oiseaux traitées selon la revendication 1, dans lesquelles les graines sont traitées avec du matériau végétal ou des extraits végétaux provenant de plantes contenant de la capsaïcine, de la résinifératoxine ou bien des analogues ou dérivés de celles-ci.

17. Graines pour oiseaux traitées selon la revendication 1, dans lesquelles l'analogue de la capsaïcine est la dihydrocapsaïcine.

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18. Graines pour oiseaux traitées selon la revendication 1, dans lesquelles l'analogue de la capsaïcine est le vanillylamide de nonanoyle.

19. Graines pour oiseaux traitées selon la revendication 1, dans lesquelles l'analogue de la capsaïcine est l'ester nonylique d'homovanillyle.

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20. Procédé permettant de repousser sélectivement des animaux qui possèdent des récepteurs sensibles à la capsaïcine, consistant à alimenter des oiseaux avec des graines traitées selon la revendication 1 en une quantité suffisante pour dissuader les animaux possédant des récepteurs sensibles à la capsaïcine de manger lesdites graines pour oiseaux traitées.

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